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University of Massachusetts

Meeting the Environmental Challenge

University of Massachusetts Amherst

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Overview

The University of Massachusetts Amherst is the major academic center for environmental education, research, and public service in the northeastern United States. On the University's 1,400-acre campus, nine schools and colleges offer bachelor's degrees in over 90 areas, master's degrees in 67 and doctorates in 50 to nearly 17,000 undergraduates and 6,000 graduate students. Located between the Connecticut River and the Quabbin Reservoir, in the richest agricultural region of the state, the Amherst campus manages 2,000 acres of experimental forest.

State and federal environmental agencies have a long history of utilizing the University as a research and professional training arm, drawing particularly on the College of Food and Natural Resources, School of Public Health and Health Sciences, College of Engineering, the Environmental Institute, and public policy experts in various academic departments. In 1992 alone, faculty researchers received more than $12 million in environmental research and training grants. The research branches of the U.S. Fish and Wildlife Service, Forest Service, and National Marine Fisheries Service have established research and education units on the Amherst campus. In 1990, the U.S. Fish and Wildlife Service opened the Silvio O. Conte Anadromous Fish Research Laboratory on the Connecticut River in Turner's Falls and moved its northeast regional headquarters next to campus in 1993. Over a dozen special campus units and programs are actively engaged in assisting members of the environmental business community in training, technology transfer, and improved business management.

The environmental expertise available at UMass Amherst addresses many of the major environmental problems identified as federal and state priorities. At the federal level, these include loss of biological diversity and habitat alteration and destruction caused by such phenomena as loss of wetlands, soil erosion, and water pollution. At the state level, identified problems include air pollution, acid deposition, solid and hazardous waste, wastewater pollution, and heavy use of agricultural chemicals.

Ensuring Clean Water

Our traditionally clean and reliable ground- and surface water systems are at risk from industrial, agricultural, and municipal waste products. In some areas, water is being pumped from aquifers faster than it is being replenished. In other areas, outdated delivery systems are contributing to water pollution through purification byproducts and lead pollution. Acid rain continues to affect lakes and forests. At UMass Amherst, researchers are working on practical solutions to these and other water resource problems.

Water Resources and Management

UMass Amherst has earned an international reputation in water resources research, particularly in the development and use of systems analysis techniques to solve problems associated with water supply, water pollution control, and hydrologic processes. Research results are used by federal, state, and local agencies to manage water resources, monitor water quality, and develop permitting plans for groundwater use. Research highlights:

- *Analysis of water supply infrastructures to assess the impact of leaks and breaks in water distribution systems and how effective planning and management can reduce water losses*
- *Studies of metal transport in aquatic systems and the relationship between water quality and the corrosion of plumbing materials*
- *Water resources risk assessments for Massachusetts towns*
- *Economic analyses of water supply and demand*
- *Study of water supply decisionmaking models and the basis of water quality standards*

The University is also a leader in water quality monitoring techniques using volunteers. The Water Resources Research Center has organized lake and river groups, state and federal agencies, and environmental non-profit groups into the Massachusetts Water Watch Partnership. Through the partnership, citizens learn how to conduct scientifically credible water quality monitoring. To date the partnership has monitored 19 river systems and 50 lakes.

The Boston Water System

Multiple studies by UMoss Amherst reseorchers determined that Bastan's water shortoge in the 1970s stemmed nat sa much fram growing demand as from mojor leoks ond unmetered use thraughaut the system. The findings furnished extensive data ta implement a policy of demond management, including leak detection ond woter conservatian practices. Plons ta divert woter from the Connecticut River to the Quabbin Reservair, which supplies woter ta the Bastan metrapalitan area, were subsequently cancelled, and legislatian was enacted ta mandate conservatian measures before water may be transferred fram ane Massachusetts river basin ta anather. As a result, demand far water has drapped below the safe yield af the system for the first time in mare than a decade, ensuring that the present system will meet Bastan's needs for the farseeable future and praviding a model for demand management useful for mony other municipal water systems in the notion.

Drinking Water and Wastewater Treatment

U.S. EPA regulations on drinking water quality, particularly for toxic metals, organics, and pathogens have caused municipalities to scrutinize existing water supply management practices. UMass Amherst is home to one of the nation's premier programs in wastewater treatment and drinking water purification techniques using physical, chemical, and biological treatment technologies. Research highlights:

- *Control of carcinogenic organic byproducts of drinking water disinfection and factors affecting byproduct formation*
- *Use of ozone and biologically active filtration to purify drinking water*
- *Removal of particulate contaminants by granular media filtration and dissolved air flotation*
- *Operation and monitoring of anaerobic digesters*
- *Site assessments for onsite sewage disposal*
- *Environmental fate of municipal sludges*

The Environmental Engineering Program

Researchers in the Environmental Engineering Program study an array of drinking water and wastewater treatment problems. Faculty recently participated in a study for the Massachusetts Water Resources Authority on optimal methods for treating Boston's water supply to meet new U.S. EPA regulations on filtration and disinfection byproducts, and are conducting similar studies for large utilities in Connecticut and New Jersey. Researchers also recently completed studies for the Massachusetts Division of Water Pollution Control on composting wastewater treatment sludge, generating useful products, and developing bioassay methods for wastewater. Faculty have authored a handbook, now widely used by plant operators, on solutions to problems commonly encountered in wastewater treatment plants. A book on ozone technology for drinking water, prepared with the help of Environmental Engineering faculty, has become a standard reference for consulting engineers worldwide.

Council for the Health and Environmental Safety of Soils

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The Council for the Health and Environmental Safety of Soils (CHESS) is based at UMass Amherst in the Northeast Regional Environmental Public Health Center. Created in 1988 in response to the critical need for national consensus on approaches to cleaning up contaminated soils, the Council provides national and international leadership in solving soil contamination problems. Through participation from University faculty, government agencies, and private industry, environmental scientists develop guidelines on analytical techniques, site assessments, risk assessment approaches, and remediation methodologies and provide education and training for the federal governments in the U.S. and Canada, state EPAs, and other agencies. Research projects include:

- *Risk assessments of contaminated soils including ingestion, uptake, and bioavailability of soil contaminants by children and adults*
- *Health effects of petroleum constituents*
- *Evaluation of remedial technologies for contaminated soils*

Acid Rain

Throughout the 1980s, acid deposition was a priority environmental concern for Massachusetts. The Water Resources Research Center earned national acclaim for the Acid Rain Monitoring Project (1982-1993), which provided scientific documentation of the effects of acid deposition on the state's water resources. By systematically monitoring the state's 5,294 lakes and streams, the Center produced the most extensive database on water quality in Massachusetts. The data were instrumental in passing a statewide referendum limiting acid emissions. The database continues to be an important index for assessing the effectiveness of the Clean Air Act and the long-term health of Massachusetts' freshwater lakes and streams. The monitoring program earned international and national recognition as a model for using volunteer sample collectors and volunteer private, municipal, and public school laboratories across the state.

Soil and Groundwater Contamination

UMass Amherst has become a major force in the nationwide effort to characterize subsurface pollution and to understand the nature of bioremediation in contaminated soils.

University engineers link geotechnical and environmental engineering techniques to address groundwater and soil contamination from the initial point of discovery to biological analysis and final remediation. Researchers have extensive field drilling and sampling experience and capabilities for innovative chemical and biological analysis in the laboratory. In the geotechnical engineering program, researchers develop and use underground sensors to measure water, soil, and soil gas contamination. Their colleagues in the environmental engineering program analyze the resulting samples for a range of contaminants.

UMass Amherst soil scientists, chemists, microbiologists, and public health scientists also have extensive expertise in the movement and fate of water, contaminants, and chemical vapors in the zone that lies between groundwater aquifers and the earth's surface. University resource economists have extensive experience in groundwater pollution and evaluation of state and local policies designed to protect groundwater supplies. Research highlights:

- *Assessment of nitrate pollution of groundwater from agricultural practices and onsite sewage disposal*
- *Distribution of heavy metals in soils and development of heavy metal detection systems*
- *Leaking storage tank site assessment*
- *Assessment of hydrocarbon remediation strategies*
- *Impact of road salt on ground- and surface water*
- *Development of field sampling techniques for assessing contaminated soils and groundwater*
- *Use of Geographic Information Systems (GIS) to develop predictive equations to relate land-use practices to groundwater contamination*
- *Groundwater protection in mixed land-use aquifers*
- *Use of microorganisms to alleviate groundwater contamination*

Amherst faculty founded the National Contaminated Soils Conference in 1985 and continue to organize and host the annual conference. More than 600 scientific and regulatory professionals attend each year to discuss problems and solutions related to contaminated soils. The Conference provides common ground for federal agencies, state agencies, industry, and environmental engineering and consulting companies to exchange information and discuss problems and solutions. The annual conference proceedings have proved useful for professionals in the field.

Sustaining Natural Resources

UMass Amherst has extensive expertise in promoting the stewardship of healthy and sustainable ecosystems. Faculty are national leaders in the areas of fire ecology, systems modeling, and regeneration of native plants and trees in New England ecosystems. The campus has an international reputation for research in wetland ecosystems and anadromous fish biology.

A major strength of the campus is the unique convergence of University, federal, and state cooperative research that is unmatched in the Northeast. Through cooperative agreements with state and federal agencies, faculty provide leadership at the state and national level in identifying and responding to applied research needs in a wide variety of resource management areas.

Marine Fisheries

The importance of marine fisheries to the Massachusetts economy has led UMass Amherst to develop a marine teaching and research program with special strengths in:

- *Seafood processing*
- *Biology, ecology, and management of anadromous and marine fish stocks*
- *Economics of marine fishing and marketing*
- *Fish waste conversion to high value products*
- *Development of underutilized fish species*
- *Biological origin of marine toxins*
- *Marine resource economics*

Research and teaching in marine fisheries is supported by a network of federal, state and industry cooperators, including scientists from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service who are assigned to the Amherst campus as researchers and graduate faculty. The University also maintains a marine research station in Gloucester.

Faculty developed the state policy guidelines for the use of short-term assays for carcinogens, serve on various state advisory boards, and actively participate in extension efforts with industry and farmers. Resource economists have documented the value of marine fishing to the state's economy and developed new approaches to marketing marine fish.

Wetlands

Massachusetts was the first state in the nation to enact legislation to prevent the loss of wetlands and to preserve the roles they play in reducing flood damage, maintaining water quality and water supply, and providing fish and wildlife habitat. UMass Amherst faculty assisted in drafting the Massachusetts laws and regulations on wetlands and in the development of similar laws in other states and in the U.S. Congress. Research has included:

- *Developing the first techniques for predicting wetland functions*
- *Conducting the first tests of the federal government's national wetlands mapping system*
- *Producing the first detailed statewide maps of wetlands*
- *Developing habitat assessment models for wetland-dependent birds, reptiles, and amphibians for use in federal and state environmental reviews*

Researchers also assess plant, soil, and hydrology relationships in support of federal wetland delineations and have mapped the wetlands of 19 states to date for the U.S. Fish and Wildlife Service. With support from the state Department of Environmental Protection, the University has managed production of orthophotoquad maps delineating wetlands for various regions of the state. These maps are important planning and policy tools for state and municipal officials and scientists.

Faculty provide extensive training in how to identify, delineate, assess, and manage wetlands. Faculty provide wetlands training education programs for all local conservation commissions in Massachusetts as well as many state and federal agency personnel and private consultants. With support from the WorldWide Fund for Nature, faculty provide wetlands training as far afield as Inner Mongolia in the People's Republic of China. Faculty advise local, state, federal, and international natural resource agencies on wetlands issues and serve as science and policy advisers to international agencies engaged in wetland conservation and management.

Sustainable Agriculture

In Massachusetts, where specialty crops vie with other land uses, the agricultural community uses the latest technology to maintain a competitive edge. As the Commonwealth's land grant institution, the University provides much of the research expertise needed to implement new agricultural programs. Cranberries are probably the best known specialty crop in Massachusetts, the world's largest cranberry producer. Because commercial bogs are developed in wetlands, drain directly into watersheds, and are located in coastal areas, limiting agricultural pesticides on cranberry bogs is particularly important. UMass Amherst entomologists are engaged in extensive research on biological controls of cranberry pests and diseases.

The University administers agricultural extension programs for growers across the state and advises state and federal agencies on research applications. The Amherst campus also coordinates biological control programs for the state. Faculty and staff conduct statewide and regional surveys of important migratory and exotic pests and work closely with state agencies to develop policies for promoting biological control. A major research focus is on reducing use of agricultural chemicals on crops. Research highlights:

- *Biological controls of vegetable pests*
- *Behavioral ecology and management of tree fruit insects*
- *Insect pest population dynamics*
- *Use of insect viruses as alternatives to chemical insecticides*
- *Pheromone disruption and mass trapping strategies*
- *Insect behavior and ecology*
- *Use of agricultural and industrial waste mulches as alternatives to agricultural chemicals*
- *Use of composted and fresh plant and animal wastes as weed controls*

University resource economists have extensive expertise in the economics of sustainable agriculture and reduced chemical and pesticide use. Research highlights:

- *Incentives for protecting farm workers from pesticides*
- *Identification of economically sustainable integrated pest management technologies*
- *Economic analyses of biologically based crop production strategies*

Forestry

Forest management offers a means to harvest timber in a controlled manner while increasing water yields and improving wildlife habitat and the health, productivity, and attractiveness of the remaining forest. Since 1977, faculty and students in the Department of Forestry and Wildlife Management and researchers in Cooperative Extension have inventoried and prepared forest management plans for 36 Massachusetts towns representing roughly one-third of the state's unmanaged forested watersheds. The forest watershed plans provide a range of alternative management strategies for town forests based on timber types, topography, soils, access, and management goals. Researchers are also conducting water yield studies on municipal watersheds in Massachusetts and Connecticut to determine optimum species mix, cutting intensity, and erosion and sediment control strategies to increase water yields in watersheds.

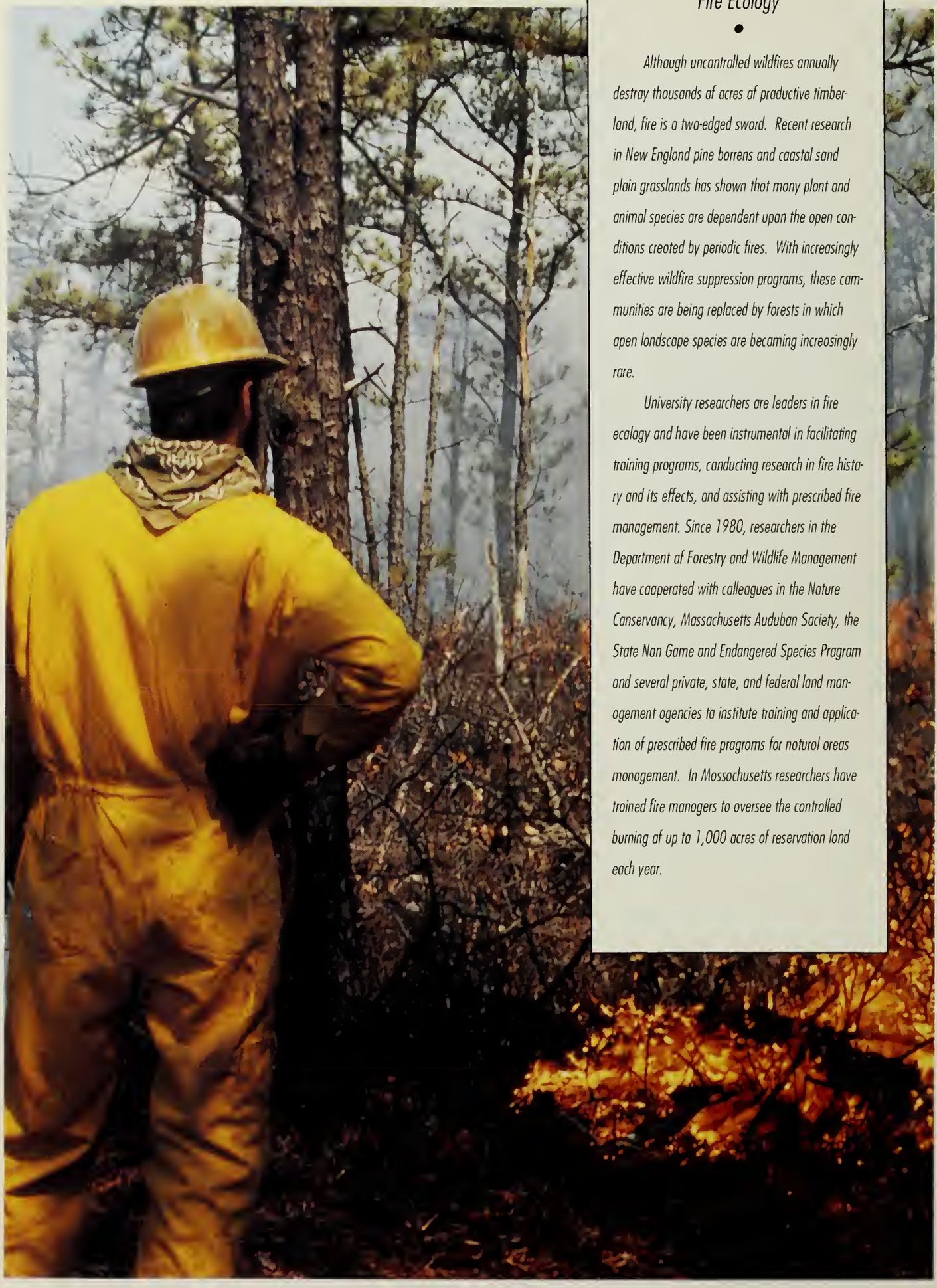
UMass Amherst has extensive expertise in forest ecology and conservation. Research includes studies of the dynamics of the gypsy moth/small mammal/oak forest ecosystem and the developmental response of tree species to defoliation and animal browsing. The University's Environmental Institute is coordinating the Forest Legacy Program, a major conservation effort in southern New England to preserve large tracts of environmentally important private forest lands through the purchase of conservation easements. Research highlights:

- *Fire and vegetation dynamics in New England ecosystems*
- *Regeneration biology of New England tree species*
- *Ecology of forest shrub species*
- *Physiology of water movement in trees with respect to drought and forest health*
- *Inventory and management systems for urban park and shade trees*

UMass Amherst also operates an active extension program offering workshops on topics such as woodlot management, forest stewardship, and timber harvesting regulations.

The Integrated Pest Management Program

UMoss Amherst entomologists ond extension specialists monoge the stote Integroted Pest Monogement Progrom (IPM), which educotes Mossochusetts growers obout the lotest research-based pest monogement technologies such os biologicol control, pesticide monogement, ond resistonce monogement. IPM focuses on forming proctices thot emphosize pest control monitoring, introduction of noturol enemies, ond culturol controls (such os plowing, crop rototion, ond pest resistont crop vorieties), introducing pesticides only where necessory. UMass Cooperative Extension reseorchers hove been teoching IPM to Mossochusetts growers since 1978. Massachusetts growers now use biologicol controls on more thon 3,100 ocres of cronberry bogs ond 1,700 ocres of pototo fields. For some crops, IPM progroms hove reduced pesticide use by os much os 40 per cent.



Fire Ecology

Althaugh uncantralled wildfires annually destray thousands af acres af praductive timberland, fire is a twa-edged sword. Recent research in New Englond pine borrens and caastal sand plain grasslands has shown thot mony plont and animal species are dependent upan the open conditions creoted by periodic fires. With increasingly effective wildfire suppression programs, these cammunities are being replaced by forests in which apen landscape species are becaming increasingly rare.

University researchers are leaders in fire ecalagy and have been instrumental in facilitating training programs, canducting research in fire histary and its effects, and assisting with prescribed fire management. Since 1980, researchers in the Department af Forestry and Wildlife Management have caaperated with calleagues in the Nature Canservancy, Massachusetts Auduban Saciety, the State Nan Game and Endangered Species Program and several private, state, and federal land manogement ogencies ta institute training and application of prescribed fire pragroms for noturol oreas monogement. In Mossochusetts researchers have troined fire managers to oversee the controlled burning af up ta 1,000 acres of reservation lond each year.

Conserving Biodiversity

Maintaining the diversity of species in our local, regional, and global environments has become a major challenge to scientists. UMass Amherst faculty play leadership roles in the conservation of biological diversity through research, policy development, and education at the regional, national, and international levels. Programs in wildlife and fisheries biology, forestry, plant sciences, entomology, and plant pathology are unique in the breadth of the species studied. Because of the number and diversity of plant and animal specialists on the Amherst campus, the University is uniquely equipped to provide scientific information and techniques needed in state and national programs to maintain species diversity.

The University has established the Biodiversity Conservation Program, a cooperative program with the state Division of Fisheries and Wildlife. Combining research, conservation education, and technical assistance, the program focuses on the conservation of biological diversity in Massachusetts and the Northeast. UMass Amherst also serves as the northeast regional coordinator for the national Gap Analysis Program, an effort by the U.S. Fish and Wildlife Service to map ecosystems and determine which essential habitats are not protected by forest and wildlife reserves, parks, and other conservation lands. Research highlights in GIS and ecosystem modeling include:

- *Management models for marine mammal populations*
- *Vegetation mapping in New England to identify critical habitats*
- *Spatial modeling of coastal wetland dynamics*

Faculty have a long record of research on animal species in the Northeast and the aquatic and plant communities that are essential to their survival. A sample of species studied includes:

- *Terrestrial species (black bears, fishers, beavers, porcupines, bobcats, deer, otter, muskrat, bats, migratory songbirds)*
- *Wetland and coastal species (reptiles, amphibians, shorebirds)*
- *Marine species (right whales, pilot whales, sea turtles, monkfish, sturgeons, Atlantic salmon, alewives, striped bass)*
- *Endangered species (piping plovers, bald eagles, Plymouth redbelly turtles, regal fritillary butterflies)*

Studying the Global Environment

University researchers are working on global problems and on research projects worldwide. Pioneering researchers in the Microwave Remote Sensing Laboratory, the largest program of its kind in the nation, use the latest engineering research to design and build unique microwave and millimeter-wave sensors for remote sensing of the earth's atmosphere and ocean and land surfaces. NASA and NOAA use remote sensing instruments developed on the Amherst campus to study sea ice, hurricanes, ocean surface winds, vegetation, soil moisture, and other phenomena on missions to Greenland, the tropics, and Antarctica.

UMass Amherst geologists and geographers have extensive expertise in climatic variability, global warming, past global change, and natural hazards and their management, including flood control. Researchers are involved in diverse studies of global change and a major research focus is the arctic region.

Arctic Research

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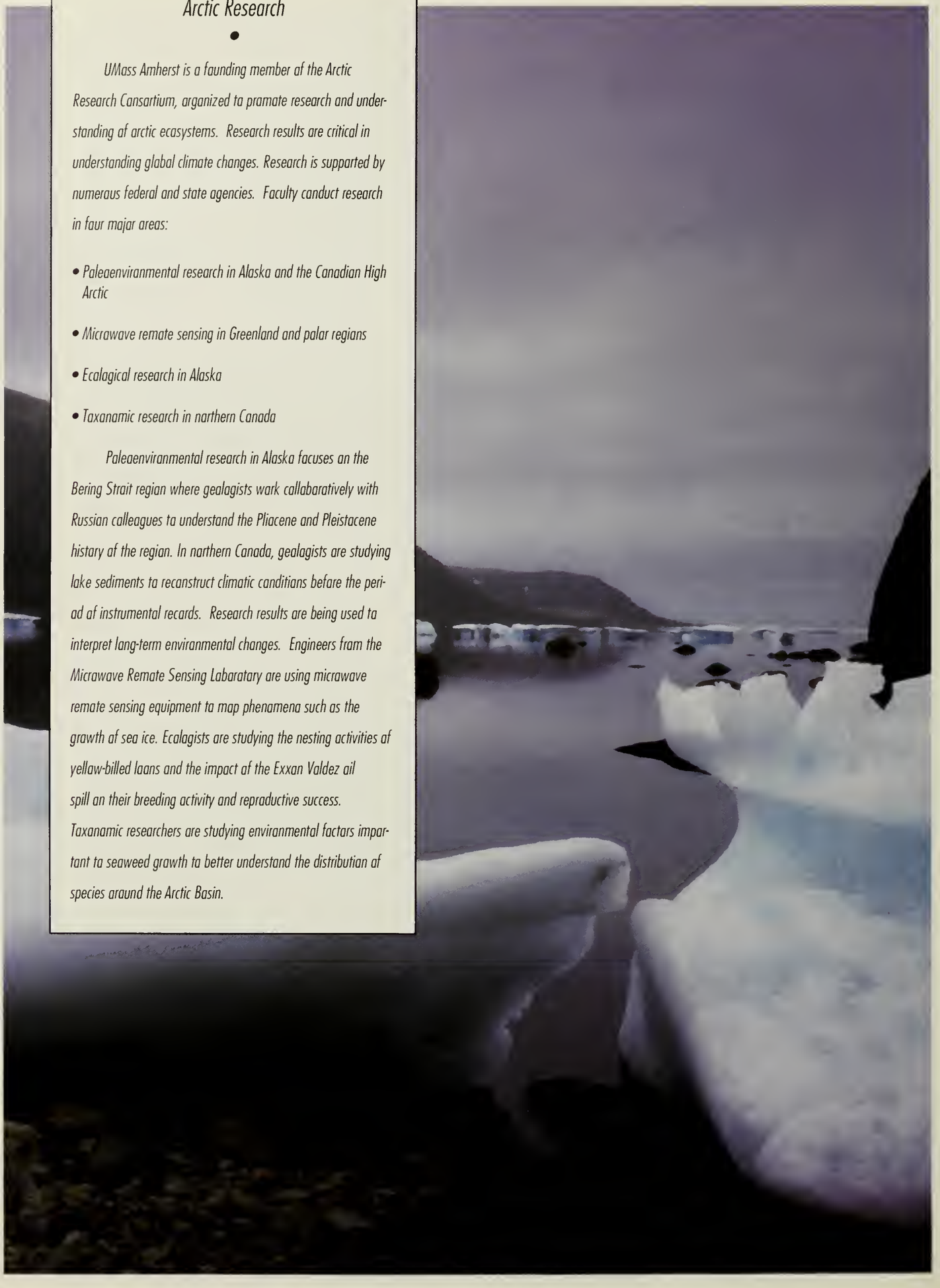
UMass Amherst is a founding member of the Arctic Research Consortium, organized to promote research and understanding of arctic ecosystems. Research results are critical in understanding global climate changes. Research is supported by numerous federal and state agencies. Faculty conduct research in four major areas:

- Paleoenvironmental research in Alaska and the Canadian High Arctic
- Microwave remote sensing in Greenland and polar regions
- Ecological research in Alaska
- Taxonomic research in northern Canada

Paleoenvironmental research in Alaska focuses on the Bering Strait region where geologists work collaboratively with Russian colleagues to understand the Pliocene and Pleistocene history of the region. In northern Canada, geologists are studying lake sediments to reconstruct climatic conditions before the period of instrumental records. Research results are being used to interpret long-term environmental changes. Engineers from the Microwave Remote Sensing Laboratory are using microwave remote sensing equipment to map phenomena such as the growth of sea ice. Ecologists are studying the nesting activities of yellow-billed loons and the impact of the Exxon Valdez oil spill on their breeding activity and reproductive success. Taxonomic researchers are studying environmental factors important to seaweed growth to better understand the distribution of species around the Arctic Basin.



University faculty are seeking solutions to environmental problems around the globe. Research ranges from ecological surveys to resource management studies to economic analyses of environmental policies. Research projects include:

- *Ecology of snow leopards in Mongolia*
- *Population dynamics of Sika deer in China*
- *Agroforestry and forest ecosystem restoration in Costa Rica*
- *Fire management in Australian shrub ecosystems*
- *Effects of dams on the Danube River in Hungary*
- *Wetland research in China and on the Danube delta in Romania*
- *Economics of sustainable agriculture, deforestation, and export agriculture in Central America*
- *International responses to transboundary environmental risks*
- *International environmental organizations and policies*

Waste Management and Materials Recycling

In recent years, waste management issues have become increasingly important as many old landfills pollute or threaten to contaminate public water supplies, and new landfills, designed to prevent this pollution, become extremely expensive to construct. In many communities, only school budgets exceed waste management expenses. Our fast-paced, throw-away society now disposes of more trash on a per capita basis than ever before. Much work needs to be done in the areas of source reduction, reuse, composting, and recycling in order to effectively manage our waste disposal problems.

The interdisciplinary nature of waste management and materials recycling is reflected in the diverse disciplines represented by Amherst faculty seeking solutions to waste management problems. UMass Amherst polymer scientists are internationally renowned for research on the development of new biosynthetic plastics, environmentally compatible polymers, and polymer recycling. Microbiologists, biochemists, and polymer scientists are working collaboratively on the practical production of biodegradable plastics. Resource economists are assessing the "pay as you throw" system for community household waste management. Engineers are studying the behavior of heavy metals during composting of sewage sludge and anaerobic treatment of landfill leachate.

The University's Office of Waste Management coordinates a comprehensive waste management program, which includes operating the largest intermediate processing facility located on a college campus in the U.S., and working with the public and private sectors on regional waste management solutions. University researchers are also engaged in educational efforts, such as directing the production of "Troubled Waters," a video on plastic waste in the marine environment, which has been broadcast on more than 100 public television stations.

UMass Amherst faculty and staff have organized a Materials Recycling Consortium comprised of University research and service organizations to focus the University's wide-ranging expertise on the problems associated with materials recycling. Consortium members conduct research and provide technical and management expertise and information on materials recycling.

One Consortium member, the Center for Rural Massachusetts, has undertaken a project called the Western Massachusetts Solid Waste Education and Enterprise Program (SWEEP). The program has provided 54 communities with technical assistance on source reduction and recycling. The project helps businesses to identify and create effective alternatives to the disposal of industrial and commercial waste and create new markets for materials that would be otherwise discarded. Program staff have produced a manual for source reduction, materials reuse, and recycling strategies.

Environmental Toxicology and Risk Assessment

UMass Amherst is a national leader in environmental toxicology and risk assessment research. Faculty in the School of Public Health and Health Sciences identify major types and sources of environmental toxins, develop methods for measuring exposure, and construct models for assessing potential risk. University public health scientists are leaders in research on indoor and industrial air pollution and advise many public agencies and private companies on pollution problems. Major research areas include:

- *Environmental toxicology*
- *Biological factors which enhance susceptibility to pollutant toxicity*
- *Toxic effects of air and water pollution on high risk groups*
- *Sampling and analysis of ambient air in the indoor and industrial environment*
- *Lead abatement programs and techniques*

Faculty in the Northeast Regional Environmental Public Health Center direct an initiative created to encourage the study of the biological effects of low-level exposures (BELLE) to chemical agents and radioactivity. Research focuses on dose-response relationships to toxic agents, pharmaceuticals, and natural products in in vitro and in vivo systems, including human populations.

University chemists are leaders in the development of spectrochemical analysis techniques to measure trace elements and their isotopic compositions. In one major research project, chemists have measured the lead concentrations and lead isotope ratios in children's blood, soil, dust, water, and household materials over a ten-year period. Two other examples of research areas are studies of the suitability of fish models for screening chemicals for toxicological evaluation and heavy metal uptake and distribution in native fish populations in the Connecticut and Housatonic Rivers.

Addressing Community Health Problems

Years after toxic chemicals contaminated two wells feeding into the public water supply in Woburn, Massachusetts, UMass Amherst researchers were called in to determine exactly where the polluted water went. By examining the condition of water pipes and the results of annual fire hydrant tests, the team managed to reconstruct the water's path and pinpoint which homes had drawn on the contaminated supplies. This information proved critical in settling a major lawsuit arising from the high incidence of childhood cancers in certain sections of the community.

When residents of Haverhill, Massachusetts could not decide whether a proposed resource recovery facility posed real dangers to public health and the environment, a team of University researchers was called in to evaluate the available technical data. The resulting third-party review helped to allay public fears, enabling local officials to reach consensus on accepting the facility.

Inventorying and Monitoring Ecosystems in Massachusetts

To understand the complex changes occurring in our environment it is crucial to have baseline measures of our natural resources. UMass Amherst has been providing baseline data to manage the state's natural resources since 1955.

Massachusetts was the first state in the U.S. to be entirely mapped for land use through aerial photogrammetry work done by UMass Amherst researchers. Researchers in the Resource Mapping Land Information Systems program have mapped and inventoried land and water use, agricultural, urban, suburban and other uses across the state to be applied in integrated resource management planning. Researchers periodically update the maps to reflect the changes, losses, and gains in wetlands, forest land, agriculture, housing, industry, and transportation within each city and town in Massachusetts. The maps are used by town planners, industry, developers, and state agricultural and natural resource agencies. UMass Amherst has been selected by the federal government to conduct most of the federal wetland mapping in the northeastern U.S.

The Spatial Data Analysis Committee (SDAC) is a consortium of academic and research units that jointly conduct spatial analysis using Geographic Information Systems (GIS). Faculty members of SDAC conduct research for the U.S. Fish and Wildlife Service, National Park Service, Massachusetts GIS, and many state and municipal agencies. SDAC maintains ARC/INFO GIS software on mainframe, workstation, and PC platforms and supports a full complement of peripheral equipment.

Mapping Massachusetts Land and Water Use

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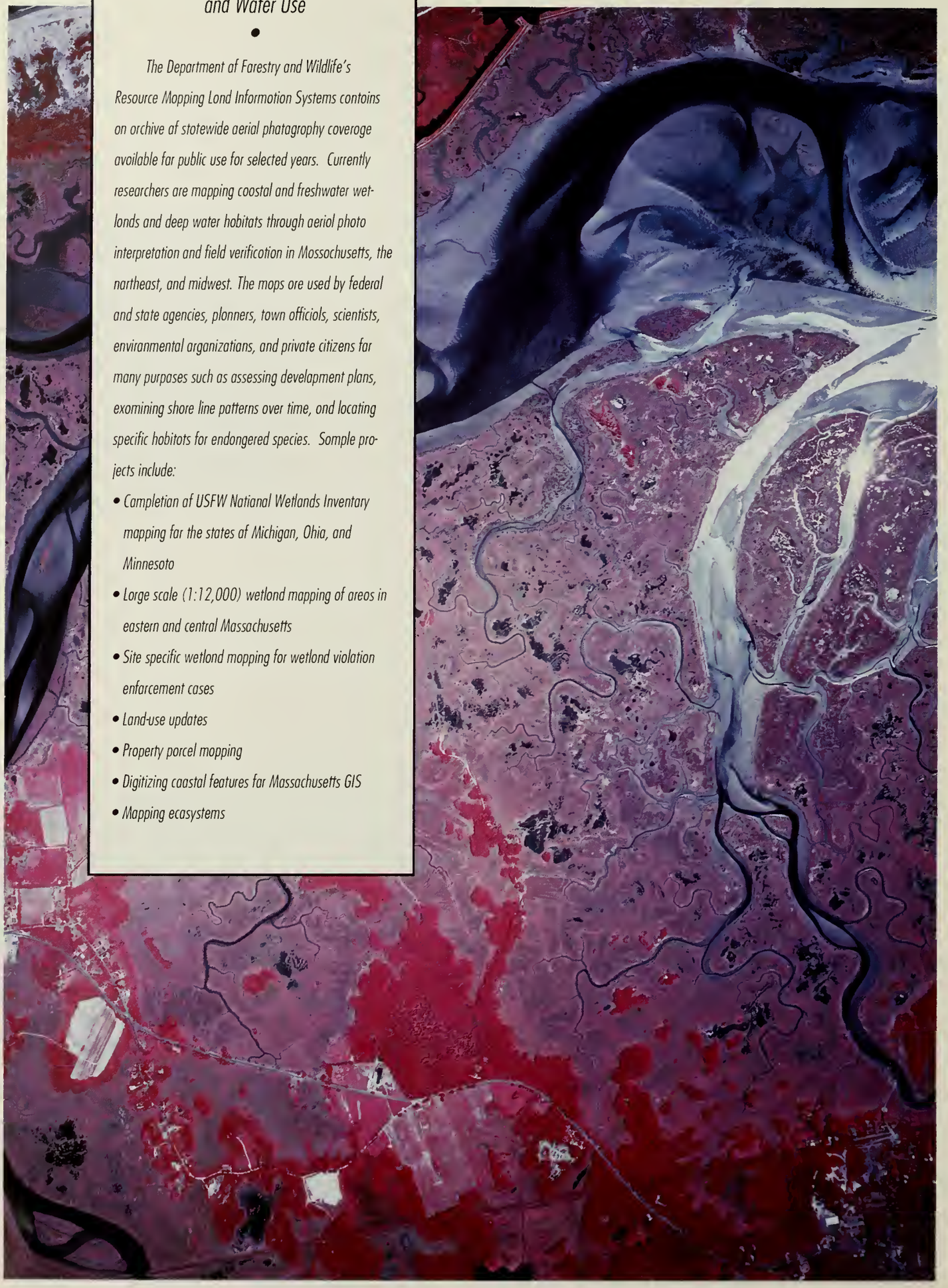
The Department of Forestry and Wildlife's Resource Mapping Lond Information Systems contoins on orchive of stotewide aerial photagrophy coveroge avoilable for public use for selected years. Currently researchers are mapping coostal and freshwater wetlonds and deep water hobitats through aeriol photo interpretation and field verificotion in Mossochusetts, the northeast, and midwest. The mops ore used by federal and state agencies, plonners, town officiols, scientists, enviranmental arganizatians, and private citizens far many purposes such as assessing develapment plans, exomining shore line patterns over time, ond locating specific hobitats for endongered species. Sample projects include:

- *Completian of USFW Natianal Wetlands Inventary mapping far the states of Michigan, Ohia, and Minnesoto*
- *Lorge scale (1:12,000) wetlond mapping of areos in eastern and central Massachusetts*
- *Site specific wetlond mopping for wetlond violation enfarcement cases*
- *Land-use updates*
- *Property porcel mopping*
- *Digitizing caastal features far Massachusetts GIS*
- *Mapping ecasystems*



Environmental Equity and Hazardous Waste Facility Sitings

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University researchers in the Social and Demographic Research Institute (SADRI) and the Northeast Regional Environmental Public Health Center are examining claims of environmental racism in the location of hazardous waste treatment, storage, and disposal facilities (TSDFs). The only earlier national study suggested that TSDFs tend to be located in zip code areas with greater numbers of minority residents. However, the University analysis is of the smaller neighborhoods contiguous to the facilities and casts doubt upon earlier studies. The second phase of the project looks at TSDF locations in relation to other industrial enterprises, examines a wider range of waste facilities including public landfills, and compares actual emissions from facilities to the sociodemographic characteristics of the neighboring communities.

Environmental Policy and Planning

University researchers have extensive expertise in evaluating existing environmental programs and exploring policy alternatives to improve environmental policies. Faculty in resource economics, political science, planning, sociology, and the natural sciences are engaged in policy research at the international, national, state, and local levels. Policy research includes:

- *National and international wetlands policy development*
- *Superfund and hazardous waste cleanup policy*
- *Policy implications of risk assessment and management*
- *Environmental equity and the distribution of environmental pollutants*
- *Regulations and economic incentives for achieving groundwater quality*
- *Contingent valuation techniques*
- *Development and environmental quality*
- *Species habitat and human recreation conflicts*
- *Economics of food safety*
- *Pesticide policy and worker safety*
- *Dairy economics*
- *International environmental policy coordination*

Faculty serve as policy advisers to a wide range of national, state, and local agencies. On the international level, they act as consultants to foreign governments, the World Bank, and to committees and commissions dealing with such global issues as climatic change, atmospheric pollution, and protection of major wetlands.

Faculty and staff are involved in environmental planning across a range of scales from municipal level land-use planning to regional policy planning and international consulting. In recent years, environmental planners have worked directly with over 50 municipalities throughout New England, and with the Massachusetts Departments of Environmental Management and Environmental Protection, the Executive Offices of Community Development and Transportation, and the Massachusetts Water Resources Authority.

University planners and landscape architects regularly consult with the National Park Service to assess and promote appropriate use and restoration of environmental and cultural resources at sites including the Blackstone Valley National Historic Heritage Corridor, Minute Man National Historic Park, and the Cape Cod National Seashore. University planners are involved in numerous international projects as well. International planning highlights include:

- *Establishment and management of GIS, most recently in Portugal and Russia*
- *Promotion of comprehensive landscape planning, most recently in Hungary*
- *Creation of new planning and design curricula, most recently in Malawi*
- *Promotion of environmentally responsible economic development, most recently in Northern Ireland*

Environmental Education and Training

Several thousand students each year enroll in environmental science and related courses and nearly one thousand of these students are majoring in subjects concerned with the environment at the graduate and undergraduate level. UMass Amherst offers more than 30 degree programs with an environmental component.

College of Food and Natural Resources		*Degrees Offered*		*Phone (413)*
Entomology	B.S.	M.S.	Ph.D.	545-2283
Integrated Pest Management	B.S.			545-2283
Environmental Sciences	B.S.			545-5226
Food Science	B.S.	M.S.	Ph.D.	545-2276
Arboriculture/Park Management	A.S.			545-2665
Forestry	B.S.			545-2665
Forestry and Wood Technology		M.S.	Ph.D.	545-2665
Natural Resource Studies	B.S.			545-2665
Wildlife and Fisheries Biology	B.S.	M.S.	Ph.D.	545-2665
Wood Science and Technology	B.S.			545-2665
Environmental Design	B.S.			545-2255
Landscape Architecture	B.S.	M.L.A.		545-2255
Regional Planning		M.R.P.	Ph.D.	545-2255
Landscape Arch/Regional Planning		M.L.A./M.R.P.		545-2255
Floriculture	A.S.			545-2242
Fruit and Vegetable Crops	A.S.			545-2242
Plant and Soil Sciences	B.S.	M.S.	Ph.D.	545-2242
Turfgrass Management	A.S.			545-2242
Plant Pathology	B.S.	M.S.	Ph.D.	545-2280
Resource Economics	B.S.	M.S.	Ph.D.	545-5732
College of Arts and Sciences				
Biology	B.A./B.S.	M.S.	Ph.D.	545-2235
Plant Biology		M.A./M.S.	Ph.D.	545-2235
Microbiology	B.A./B.S.	M.S.	Ph.D.	545-2051
Biochemistry/Molecular Biology	B.A./B.S.			545-0353
Molecular and Cellular Biology		M.S.	Ph.D.	545-3246
Chemistry	B.A./B.S.	M.S.	Ph.D.	545-2291
Geography	B.A./B.S.	M.S.		545-2286
Geology	B.A./B.S.	M.S.	Ph.D.	545-2286
Political Science	B.A.	M.A.	Ph.D.	545-2438
Public Administration		M.P.A.		545-2438
Polymer Science and Engineering		M.S.	Ph.D.	545-3149
Economics	B.A.	M.A.	Ph.D.	545-2590
Sociology	B.A.	M.A.	Ph.D.	545-0577
College of Engineering				
Civil and Environmental	B.S.C.E.	M.S.C.E.	Ph.D.	545-2508
Engineering		M.S.Env.E.		545-0685
School of Public Health and Health Sciences				
Public Health		M.S. M.P.H.	Ph.D.	545-4271

Professional Training Courses

UMass Amherst faculty provide short, professional training courses for local, state, and federal agency staff in many environmental subject areas. Professional training courses offered to date include:

Chemistry of Soil and Water Contaminants
Drinking Water Treatment
Ecology and Wildlife Management
Fate and Transport of Heavy Metals
Hydric Soils
Hydrogeology
Indoor Air Monitoring and Evaluation
Landfill Liners
Lead Abatement Training
Lead Inspector Training
Municipal Solid Waste Incinerator Ash
Quantitative Risk Assessment
Chronic Disease Epidemiology
Principles of Fisheries Stock Assessment
Risk Communication for Administrators
Sample Collection and Analysis
Techniques for Effective Public Presentations
Toxicology and Risk Assessment
Wetlands Identification and Delineation
Wetlands Wildlife Management

The Amherst campus has numerous centers providing research, training, and environmentally related services. Unless otherwise indicated, all telephone numbers are in the 413 area code.

Research and Training Centers

Center for Environmentally Appropriate Materials 545-3065

A partnership between the University's Amherst and Lowell campuses, the Center promotes the development of environmentally compatible polymers through research and education. Researchers focus on the total life cycle of materials, from synthesis through processing and use to final disposal. The Center serves as an industry resource in the fields of materials recycling, biodegradation, materials reuse, and product design.

Center for Rural Massachusetts 545-0153

The Center conducts research and serves rural communities throughout the Commonwealth on issues related to environmentally responsible growth management, preservation of rural character, and innovative land-use regulation. Administered through the Department of Landscape Architecture and Regional Planning, the Center provides model planning and zoning policies and assists communities with consensus building and implementation.

Marine Station (508) 281-1930

The Department of Food Science maintains the UMass Marine Station in Gloucester, staffed by faculty and graduate students who conduct basic and applied marine research. The Station provides deep mooring for research vessels and has well-equipped laboratories and facilities for marine research.

METLAND 545-0930

A research and service center in the Department of Landscape Architecture and Regional Planning, METLAND has conducted research in landscape planning for over 20 years and is an internationally respected leader in the use of GIS for municipal and regional planning. METLAND research focuses on appropriate planning for land resources including preservation of agricultural lands, growth management, water resource planning, wildlife habitat planning, and scenic landscape protection.

Northeast Regional Environmental Public Health Center 545-3164

Administered through the School of Public Health and Health Sciences, the Center addresses environmental public health problems in the six New England states through research, teaching, and service. It also provides education and training programs and reviews and develops environmental public health policies. Activities are guided by an executive committee from the six New England states' Departments of Health as well as the U.S. EPA and the Public Health Service. The Northeast Regional Lead Training Program, established by the EPA and housed at the Center, is a cooperative effort by the School of Public Health and Health Sciences and the Division of Continuing Education at UMass Amherst, the Work Environment Laboratory at UMass Lowell, and the New York State School of Industrial and Labor Relations at Cornell University. The program facilitates a national network of professionals qualified to identify and control lead in residential paint, soil, dust, and water and offers courses for project supervisors, contractors, abatement workers, and inspectors.

Social and Demographic Research Institute (SADRI) 545-3416

SADRI is the research arm of the Department of Sociology, providing expert consultation to a large number of federal and state agencies and foundations on a broad range of policy issues. Examples of environmental policy issues addressed include citizen assessments of environmental programs and environmental equity.

The Environmental Institute 545-2842

A unit of the Graduate School, the Environmental Institute serves public agencies and private industries desiring a central access point to the campus' environmental research expertise. The Institute assembles research teams drawn from all campus academic units, organizes professional training courses on many environmental topics, and administers the Cooperative Agency Program (CAP). Through CAP, the Institute negotiates cooperative research and training agreements between the University and state and federal environmental agencies. Within the Environmental Institute are three specialized units:

Water Resources Research Center 545-2842

The Center encourages and supports a diverse program of research, information transfer, and public service and training, accessing the talents of all academic

institutions in the state to meet state, regional, and federal water resources needs. The Center is part of a national network of 54 water resources institutes, the National Institutes for Water Resources, acting in consort to advance water resources research.

UMass Archaeological Services (UMAS) 545-1552

UMAS provides field archaeological services including archaeological surveys, site evaluations, and data recovery projects and holds workshops and seminars on related laboratory techniques. The unit involves faculty, staff, and students and serves many state and federal agencies and municipalities in Massachusetts and other New England states.

Cooperative Marine Education and Research Program 545-2842

UMass Amherst was the first university to host this cooperative program between a university and NOAA's National Marine Fisheries Service. The program supports a broad array of marine research, education, in-service training, and demonstration programs.

Video Instructional Program 545-0063

The Video Instructional Program (VIP), part of the College of Engineering, brings courses from many campus departments to working professionals in the field using videotape and satellite broadcast. The VIP delivers credit and non-credit courses to professionals at more than 300 work sites across the country and businesses register some 1,500 employees annually. Students communicate with faculty during live broadcasts, reserved VIP phone hours, and through electronic mail. The VIP is a member of the National Technological University and offers M.S. degrees in hazardous waste management and health physics among others. VIP also has teleconferencing facilities and capabilities.

Centers Offering Environmental Services

Cartographic Information Research Services 545-0359

As the state office of the U.S. Geological Survey's Earth Science Information Center, the Center provides the public with cartographic, geographic, and remote sensing data including aerial photography and National Wetland Inventory maps for nine states.

Cranberry Experiment Station (508) 295-2212

The College of Food and Natural Resources adminsters the Station, located in East Wareham. The Station supports the cranberry industry through research and extension services aimed at maximizing crop production while minimizing environmental impacts.

Environmental Analysis Laboratory 545-2936

Part of the Water Resources Research Center in the Environmental Institute, this state-certified laboratory conducts high quality inorganic analyses of water, sediment, or tissue samples. Analytical work is geared toward publicly supported environmental research, management, and monitoring activities, particularly water-related efforts requiring substantial numbers of samples.

Feed, Seed, Fertilizer and Soil Analysis Laboratory 545-2311

Laboratory staff ensure that seeds and fertilizers sold to home and commercial gardeners in Massachusetts meet legal standards and provide soil testing services to homeowners and commercial farmers.

Massachusetts Pesticide Analysis Laboratory 545-4369, 545-4626

The Laboratory is a U.S. EPA/Department of Food and Agriculture supported enforcement laboratory which services the Commonwealth by analyzing formulated pesticides, investigating pesticide use complaints, and promoting groundwater protection strategies.

Mass Spectrometry Facility 545-2771

A unit of the Agricultural Experiment Station and part of the College of Food and Natural Resources, the facility provides analytical chemical support services to state, federal, and municipal governments; private industry; and the university community. Laboratory staff analyze pesticide and petroleum residues in soil and water samples; identify bioactive compounds in animals, insects, microorganisms, and plants; and detect flavoring agents and natural toxicants in foods.

Microanalysis Laboratory 545-0045

The Laboratory conducts a variety of analytical tests on samples to determine their elemental constituents.

Office of Waste Management 545-4386

The Office operates a state-of-the-art Intermediate Processing Facility and accepts materials from numerous towns, small businesses, and schools in addition to managing the University's comprehensive waste management program.

Urban Forestry Diagnostic Laboratory 545-3208

Serving commercial and municipal organizations, laboratory staff diagnose and identify problems in woody plants and related insect pest specimens. The Laboratory is supported by the U.S. Forest Service, the Massachusetts Department of Environmental Management, and the Cooperative Extension System.

This publication was prepared with the assistance of the University Environmental Resources Coordinating Committee, composed of faculty and staff members from four colleges and 13 departments on the Amherst campus. Readers are encouraged to call the listed telephone numbers to obtain additional information on programs. For information or questions not addressed in this publication, please contact:

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